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PBIS Performance Testing Data Analysis

05 March 2003

PBIS Performance Testing Analysis

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Purpose:

To perform an Independent Verification and Validation (IV&V) of data collected during the February 2003 PBIS performance testing and determine any resulting trends, deviations, or errors that impede system performance.

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Test Plan

- 27 testers from FMB, NAVAIR, USMC, N4, N7, N89, and BearingPoint from a wide variety of computing networks and desktop PC configurations.
- Progressively increased the number of testers logged into and performing query and issue update operations on PBIS.
- Testers executed 8 pre-scripted operations and recorded data for analysis.
- PBIS Testing financial data was taken from the “PBIS 2003:PROGRAM/BUDGET – Working” table.
- Testing was performed on the PBIS Test and Evaluation site.

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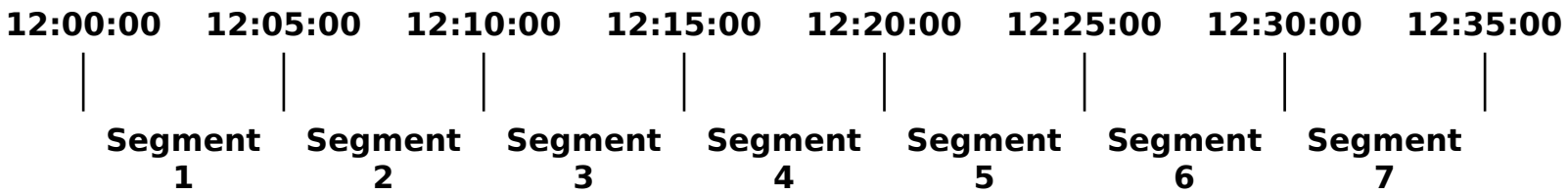
Analysis Notes

Individual Test Characteristics:

Test	Output Function	Display Location	Records Sampled	Lines of Output	Robustness
PT-1	Display Totals	PBIS	183	92	Small
PT-2	Display for Edit/Delete	PBIS	210	210	Small
PT-3	Indent Report	Adobe	1,820	116	Medium
PT-4	Export	Excel	280	188	Small
PT-5	Display Totals	PBIS	130,374	29	Medium
PT-6	Display for Edit/Delete	PBIS	592	747	Medium
PT-7	Indent Report	Adobe	14,736	1,358	Large
PT-8	Export	Excel	15,479	747	Large

Reliable testing data for analysis ends at T+35:00 (12:35:00).

Testing timeline is broken down into 5-minute segments:



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Conclusions

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Analysis of PBIS Performance Testing data:

- Test plan worked well. 552 query data points from 27 concurrent users.
- Oracle database backend monitoring revealed no database performance issues.
- The most significant degradations to performance were observed for:
  - PBIS output functions that transfer results to other non-PBIS applications (Adobe PDF and Excel) – *Slides 10-13, 30-31, and 34-35*
  - Internal display functions for large numbers of output rows. (Additional independent testing and analysis revealed that the number of rows of output has a much greater effect on elapsed time than number of database records processed) – *Slides 17-18*
- A user, either accidentally or intentionally, can execute an operation which severely degrades the performance of PBIS to the point where it appears to have “frozen” or “locked up”. – *Slide 8*
- Different networks and user PC configurations didn’t impact performance. – *Slides 15-16*

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Next Steps (Post N802 Review)

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Investigate apparent front-end bottleneck(s):

- Define process steps and identify problem points.
- Identify any web/application server capacity or configuration limitations
- Optimize Java coding
- Establish front-end performance monitoring processes

Establish safeguards to minimize risk and/or impact of runaway queries

- Preventive measures
- Detection and resolution procedures

Investigate marginal data importing performance.

Establish Standard Operating Procedure (SOP) to frequently run baseline query(s) to monitor system performance.

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Supporting Data and Analysis

Runaway Query

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Tester mistakenly executed PT-7 as a “Display for Edit/Delete” vice “Indent Report” at 12:36:45.

- 14,375 database records processed
- 13,435 rows of output
- Results never returned

Average delay prior to was 19 seconds

Average delay after was 45 seconds

Shows that even following a script doesn’t prevent a user from mistakenly executing an action that will severely impact system performance.

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Number of Queries in Execution

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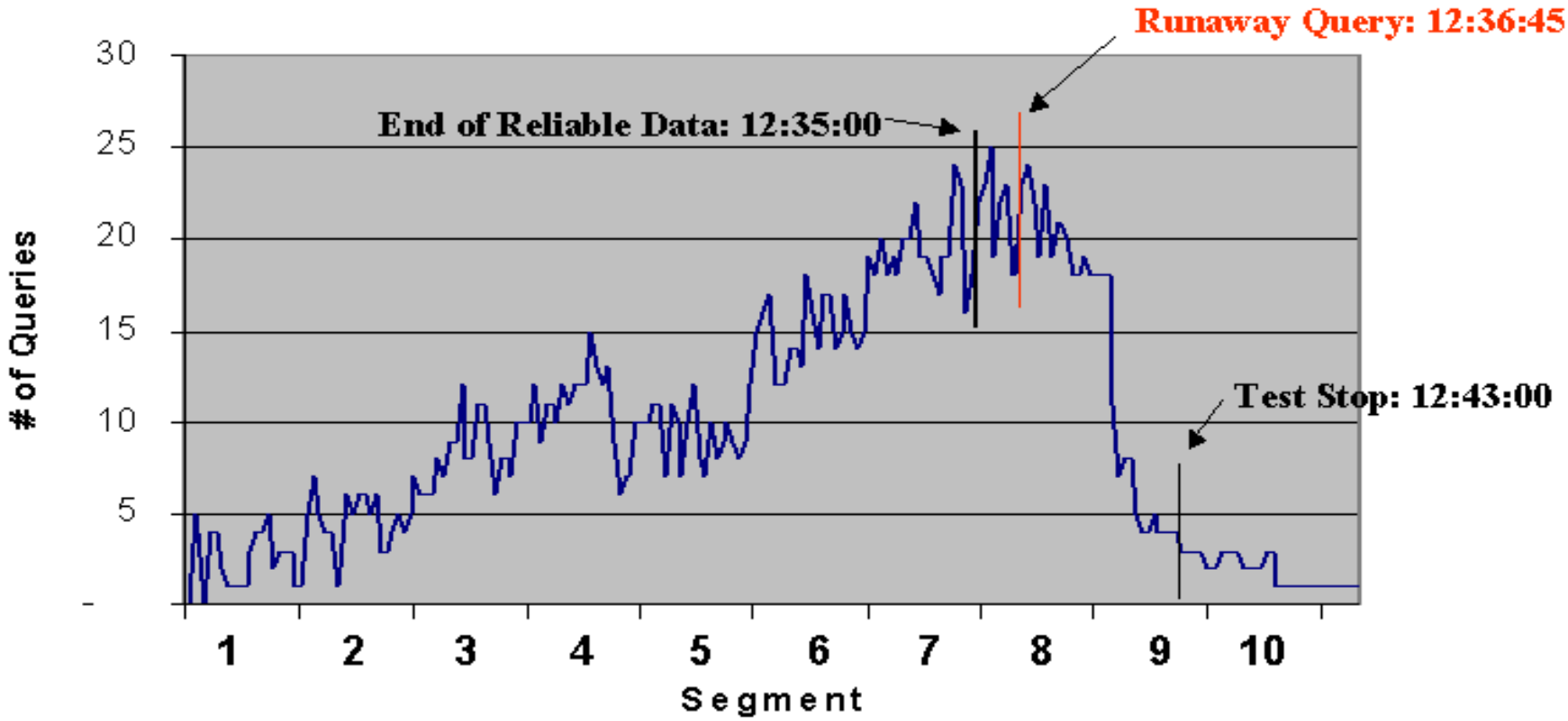

Reliable data was collected only through Segment 7 (12:35:00). At 12:36:45 a runaway query was executed and massively degraded performance of all subsequent tests.

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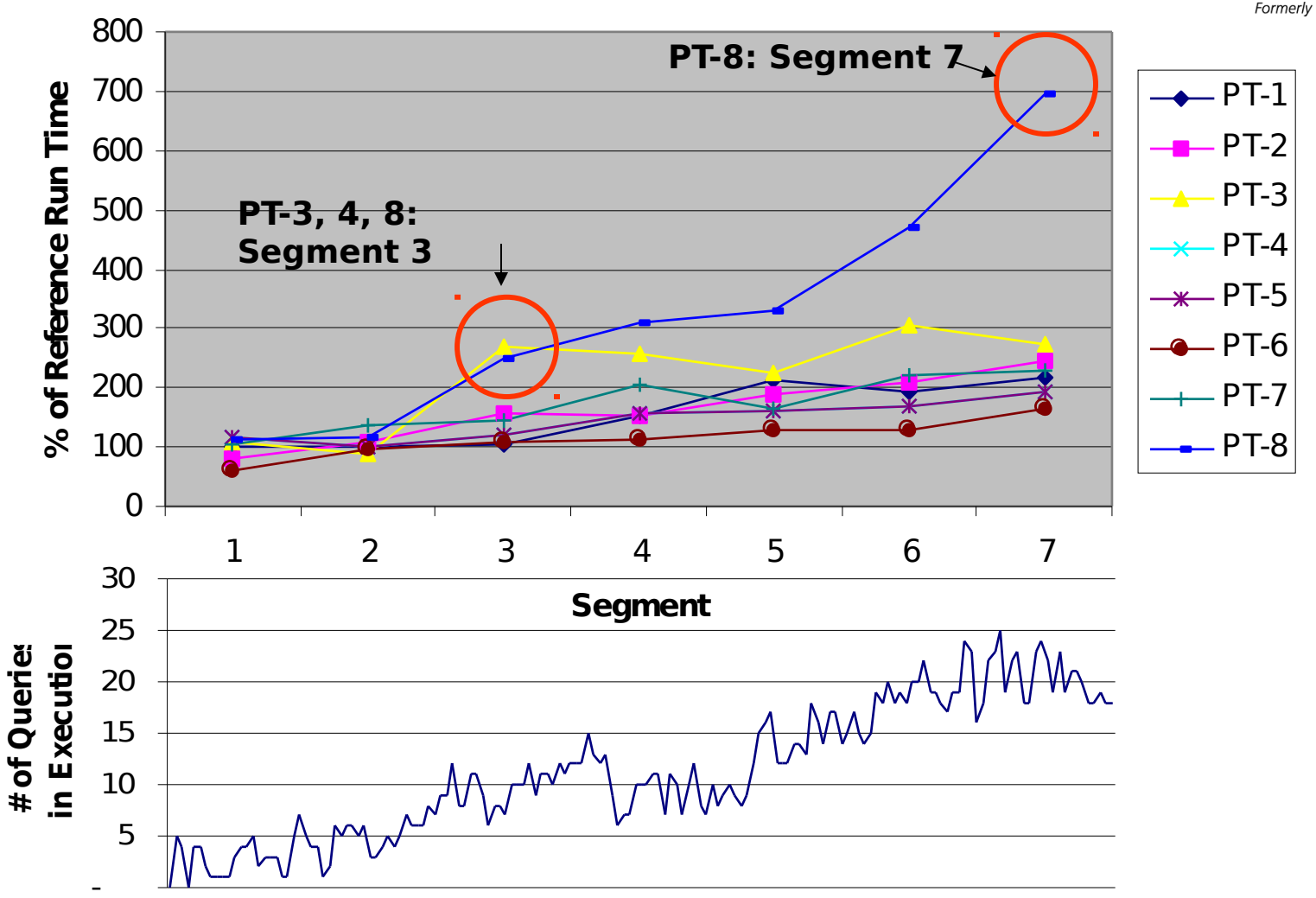
Query Performance as a % of Reference Run Time



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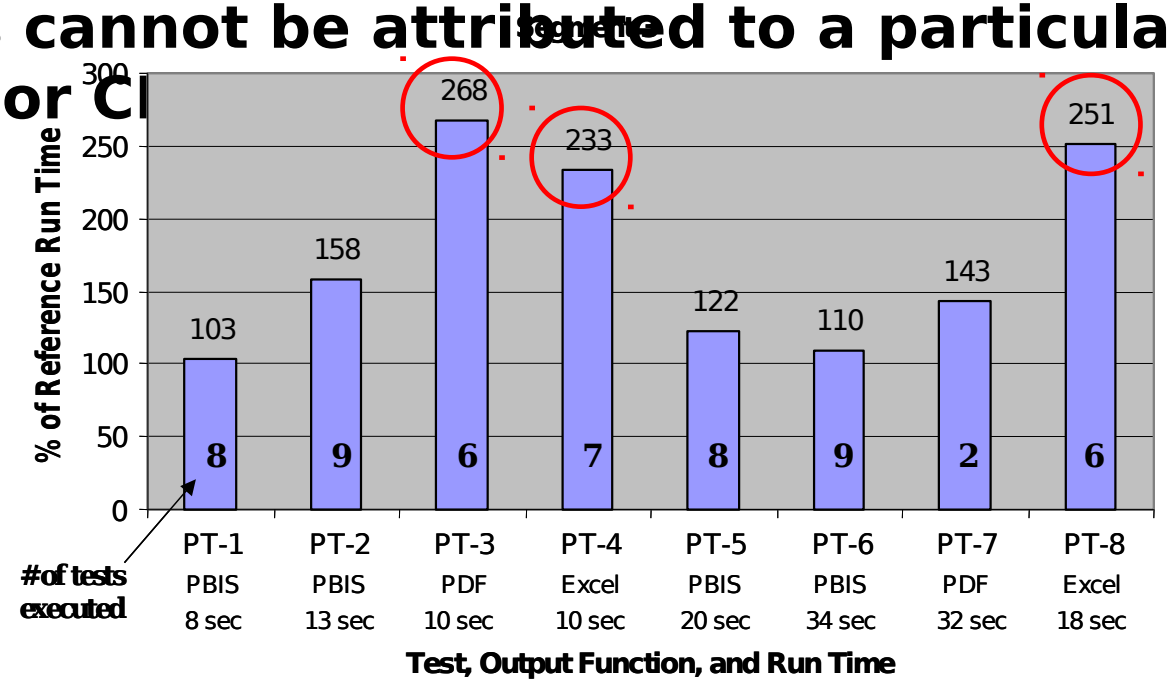
PT-3, 4, 8: Segment 3

First significant increases in elapsed time.

PT-3, 4, and 8 export information into non-PBIS applications.

Increases cannot be attributed to a particular user, network, or Cl



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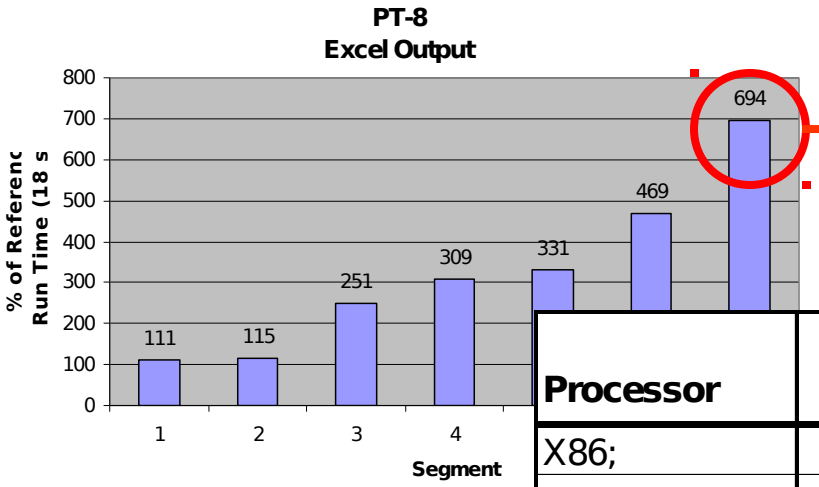
PT-8: Segment 7



Processor	RAM	Network	Start	Stop	Elapsed Time
X86;	128 MB	DNHN	0:34:53	0:36:29	96
Celeron; 1.2 G	128 MB	NMCI	0:31:35	0:33:20	105
X86;	128 MB	DNHN	0:32:28	0:34:18	110
P4; 1.8 G	256 MB	USMC	0:30:03	0:31:54	111
P 3; 1 G	261 MB	NMCI	0:30:25	0:32:25	120
P3; 1.0 G	262 MB	NMCI	0:32:10	0:34:10	120
P3; 1.0 G	256 MB	NMCI	0:30:06	0:32:20	134
P4; 2 G	264 MB	NMCI	0:32:00	0:34:15	135
X86;	128 MB	DNHN	0:30:53	0:34:07	194

The delay cannot be attributed to a network or CPU. The only commonality is this is an “export” to Microsoft Excel.

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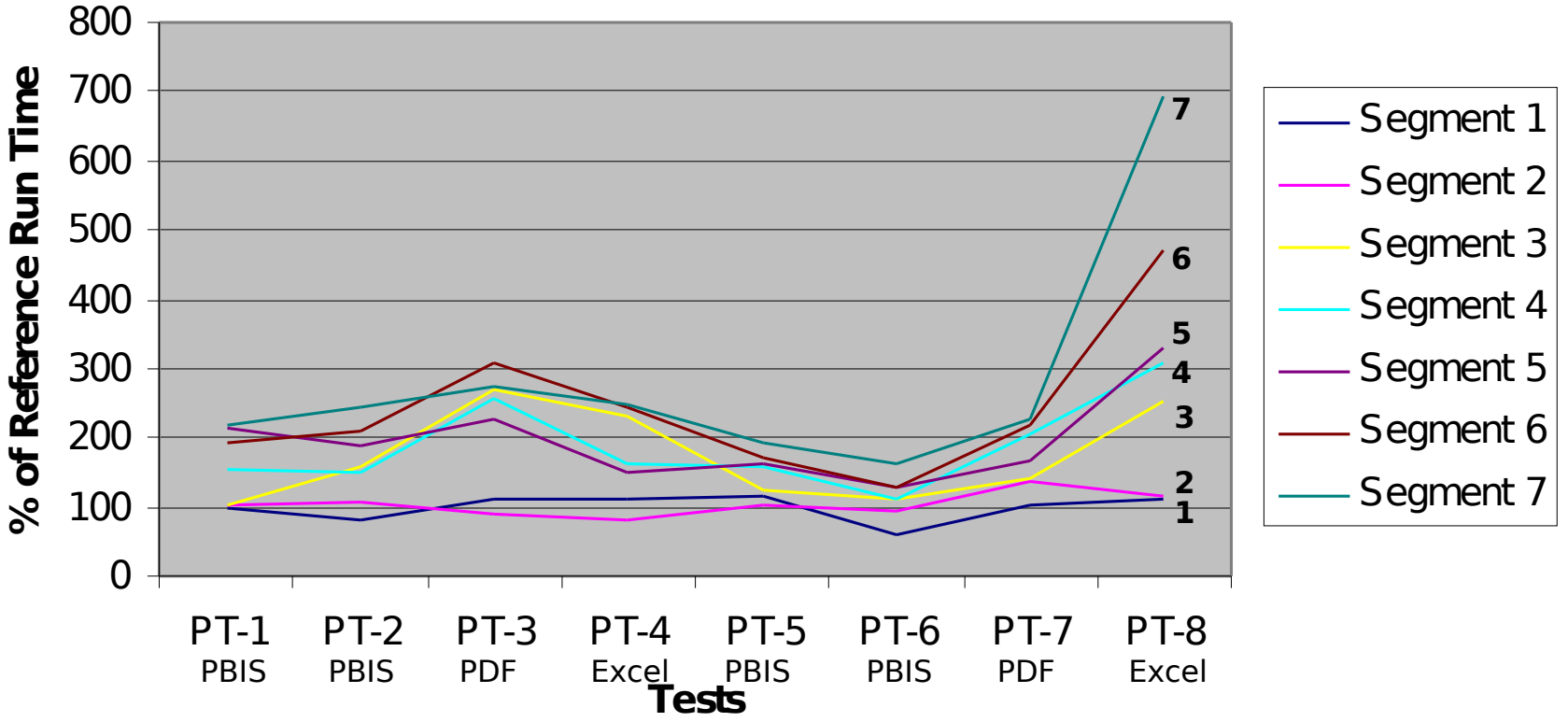
Query Performance by Segment



Degradations to PT-8 performance without any evidence of database problems points to the front-end side of PBIS vice the back-end.

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Issue Updates

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Performed 18 individual Issue Updates:

- No increase in elapsed time was experienced until the runaway query.

Imported 1,509 Issues:

- Two reference imports were conducted one day prior to testing.
  - Average elapsed time of 14:52 (mm:ss), 1.69 records per second
- Performance testing import executed at 12:05:49 (Segment 2-6)
  - Elapsed time was 24:22 (mm:ss), 1.03 records per second

- No evidence that the import negatively effected query or reporting operations.
- Investigating to determine whether import delay was a function of the front end or back end of PBIS.

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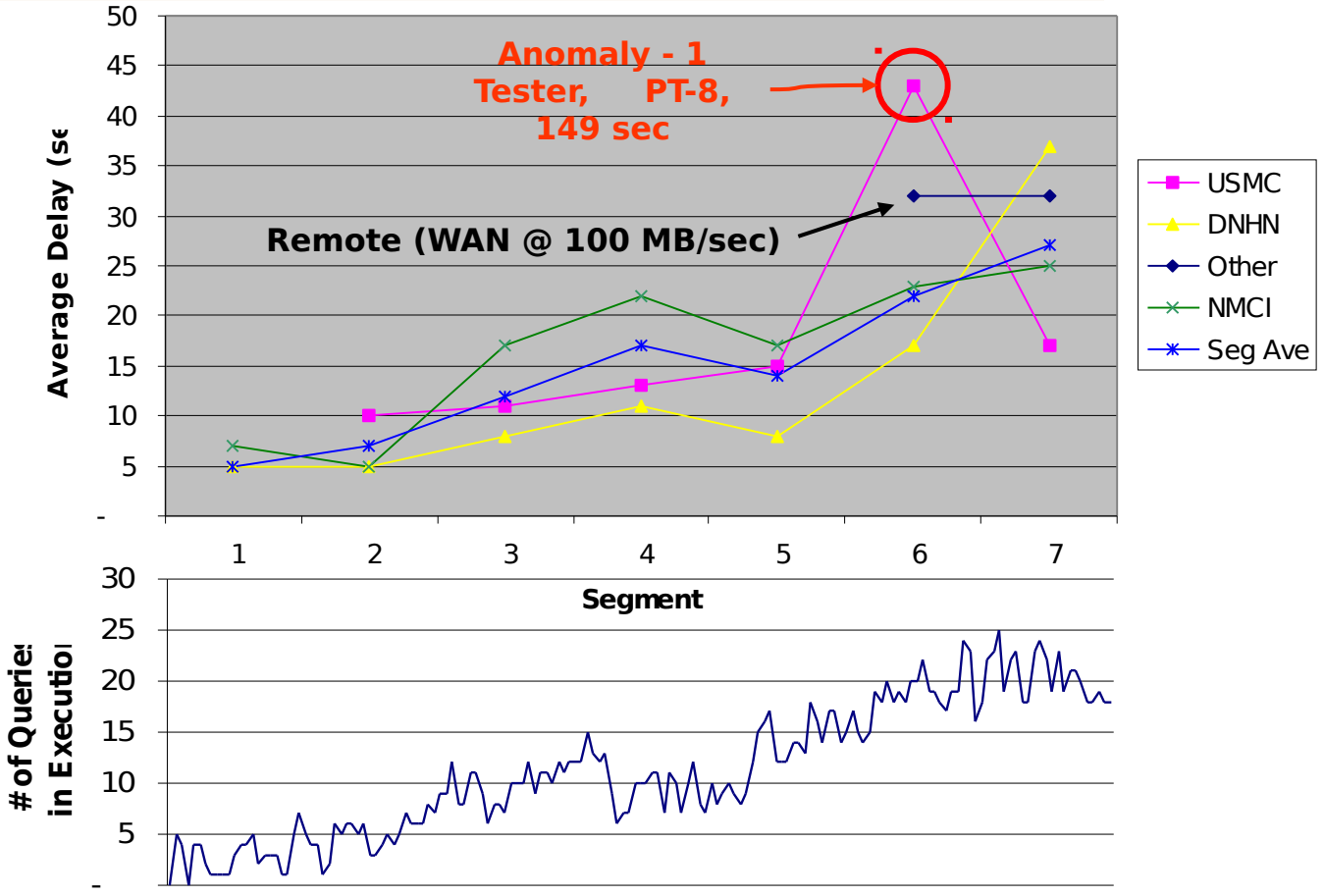
Delays as a Function of Network



With the possible exception of NMCI and remote connections, PBIS operated comparably over varying networks.

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Other Observations

As testing progressed, multiple testers commented that they began to experience a 10-30 second delay to navigate between screens in the "Query Manager" and "Issue Manager" sections of PBIS.

- Only one tester recorded supporting data in Segment 7

Individual tester computers (processor or RAM) didn't negatively impact PBIS performance.

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Subsequent PBIS Performance Testing:

Output vs. Lookups

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- Performed independent “Display Totals” tests on select queries picked from original PBIS Testing. Query characteristics were changed to determine affect on Elapsed Time and to identify consistent patterns and trends
- Functions performed in test include removing fields from the display order column, limit query to selected appropriation or program element and variations thereof
- The expanded testing of PT 5 produced results that revealed a vulnerability for Elapsed Time to increase as Output (# of Rows) increases regardless of the presence of titles.
- Sample of findings shown below:

PBIS TESTING REVIEW				
Display Totals -	Titles	Elapsed Time (sec)	Output (Rows)	DB Records Processed
PT 5 - APPN	Yes	20	31	130,374
	No	21	31	130,374
PT 5 - APPN, RS, BSO, and PE	Yes	263	10,359	130,374
	No	247	10,359	130,374

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Subsequent PBIS Performance Testing:
Findings

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- Long delay times for test Output result from a combination of two query characteristics:
  - The query runs through a large number of database records processed
  - The query returns a high number of output rows
- Number of Output rows has a greater effect on Elapsed Time than number of database records processed
  - Oracle processing of database records defined by filters is very efficient even for large numbers of records
  - The delays observed result from a large number of Output rows processed for display, reports, or export
- Considering the preliminary results of the data analysis from the 13 February PBIS Performance Testing, these findings coincide with the potential performance limitations of either the web/application servers or Java coding

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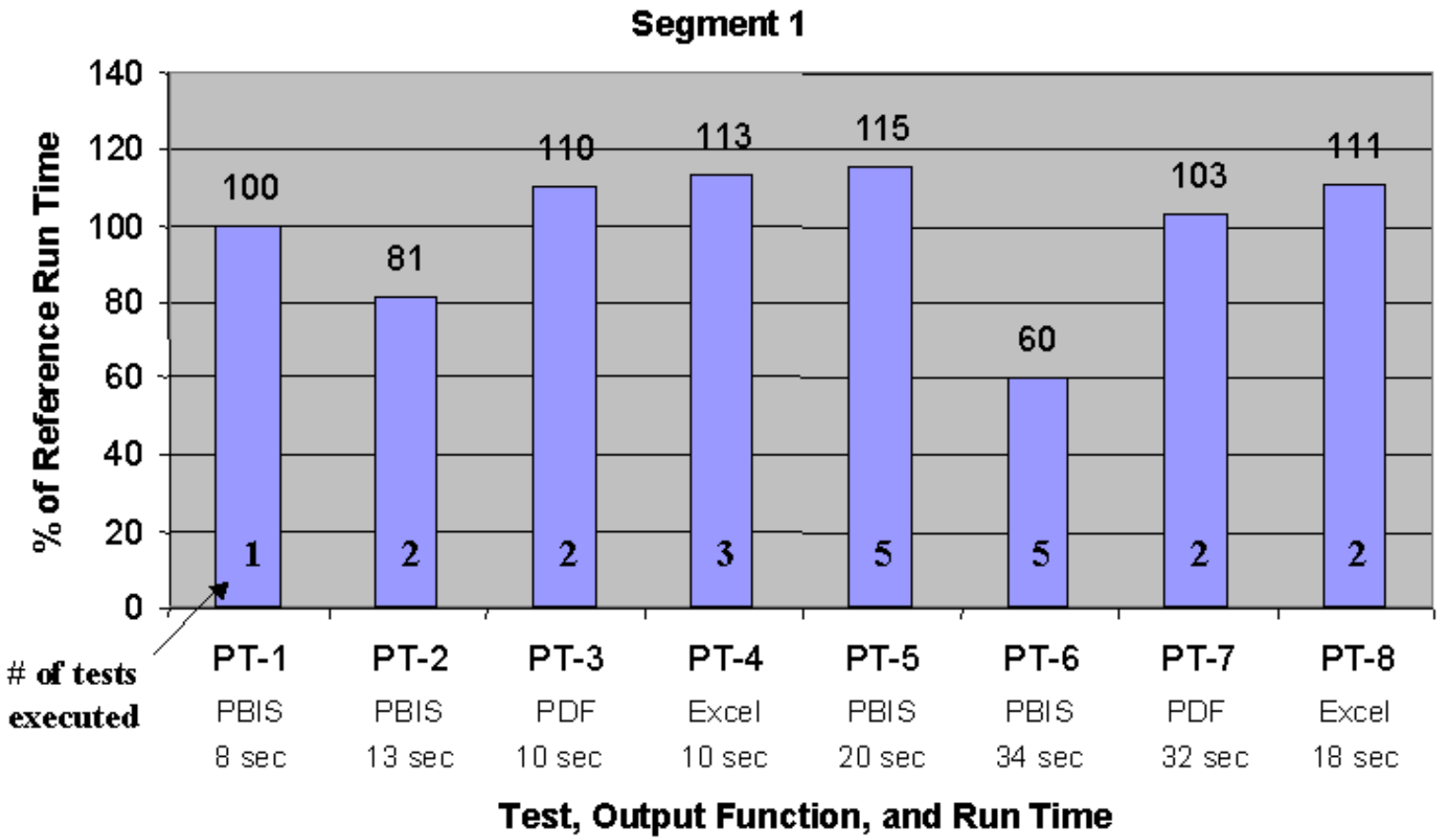
Backup Slides

Delays by % of Reference Time



22 Tests were executed during Segment 1

Delays by % of Reference Time

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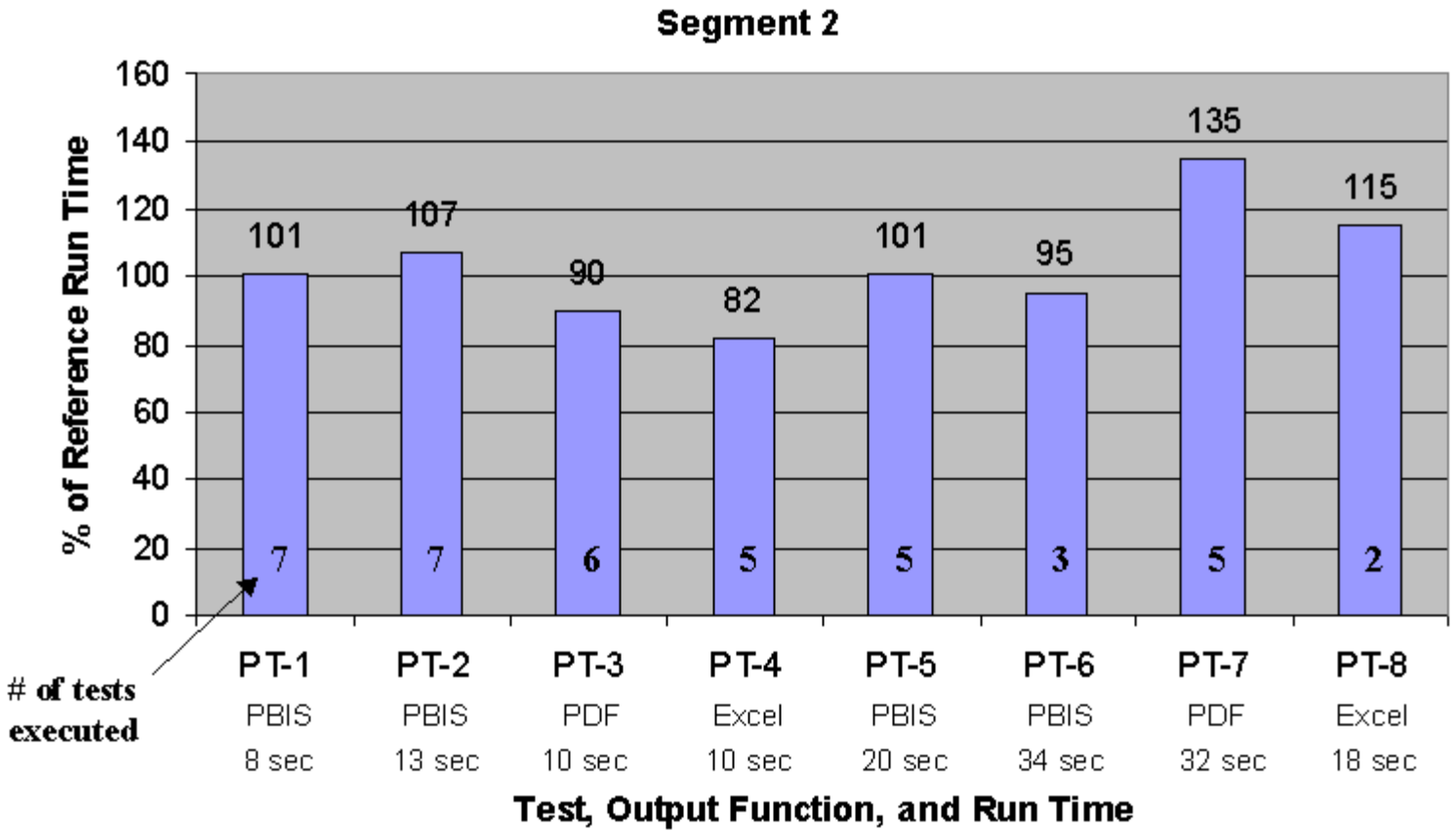

40 Tests were executed during Segment 2

Delays by % of Reference Time

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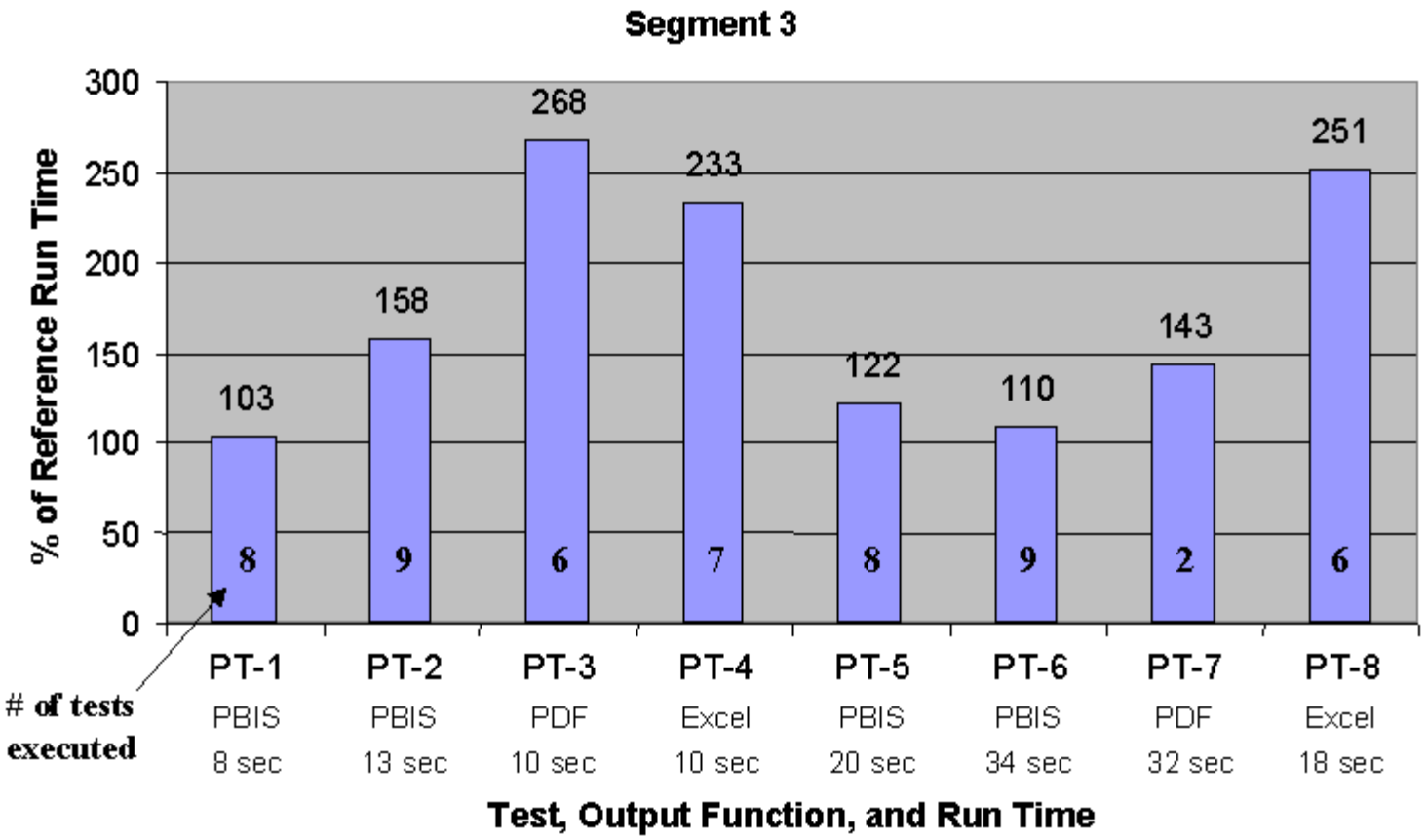

58 Tests were executed during Segment 3

Delays by % of Reference Time

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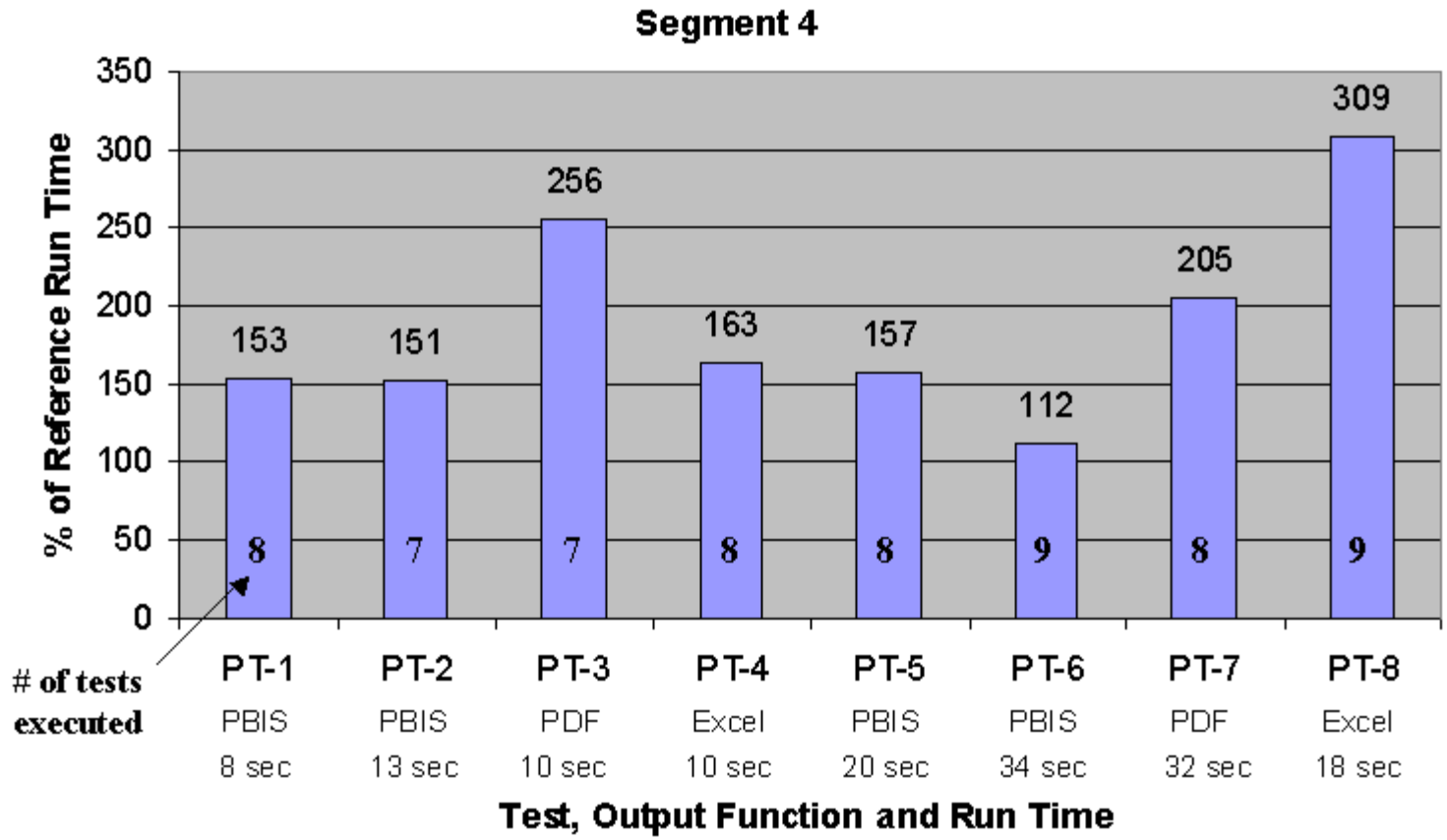

64 Tests were executed during Segment 4

Delays by % of Reference Time

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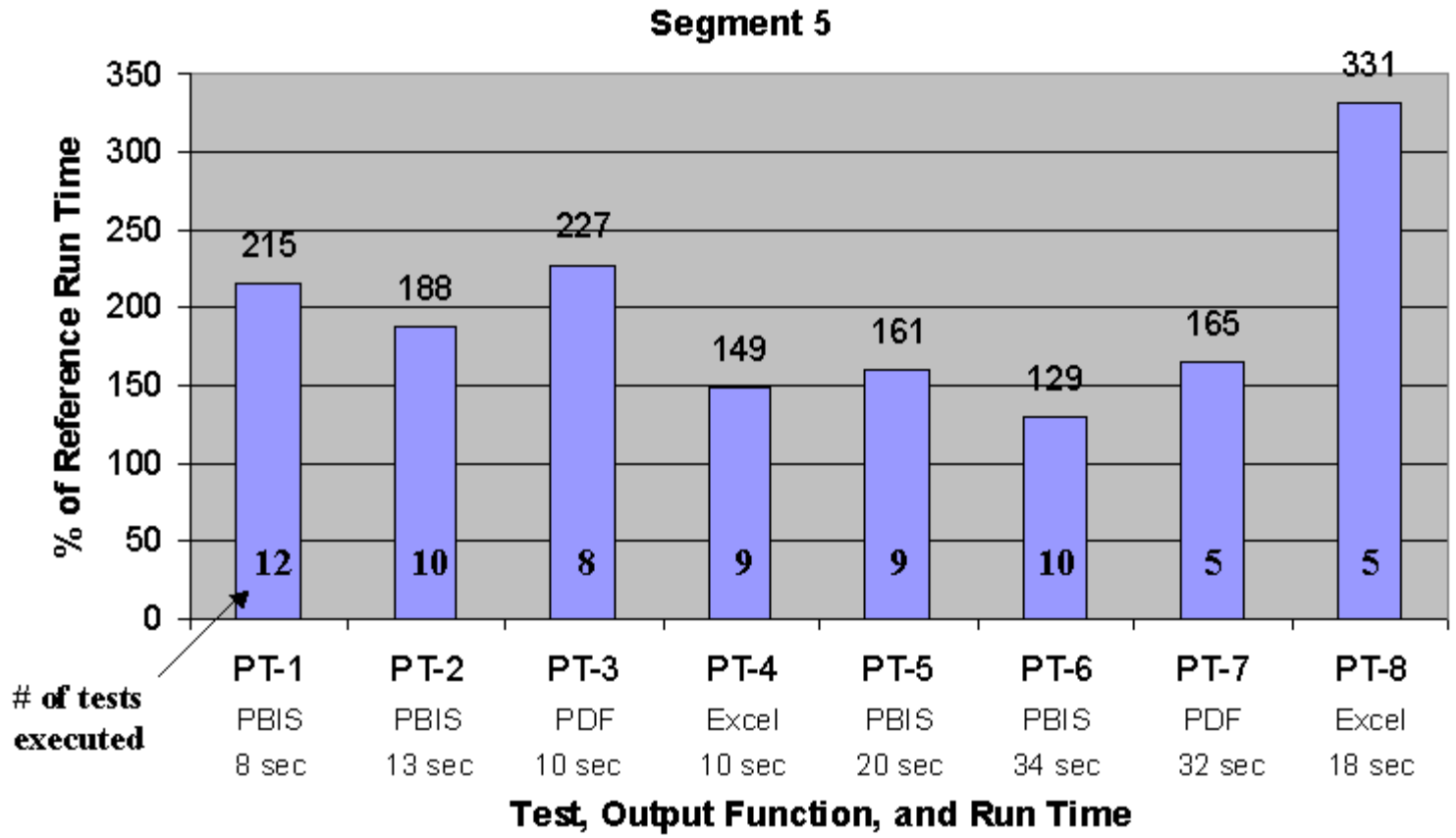

68 Tests were executed during Segment 5

Delays by % of Reference Time

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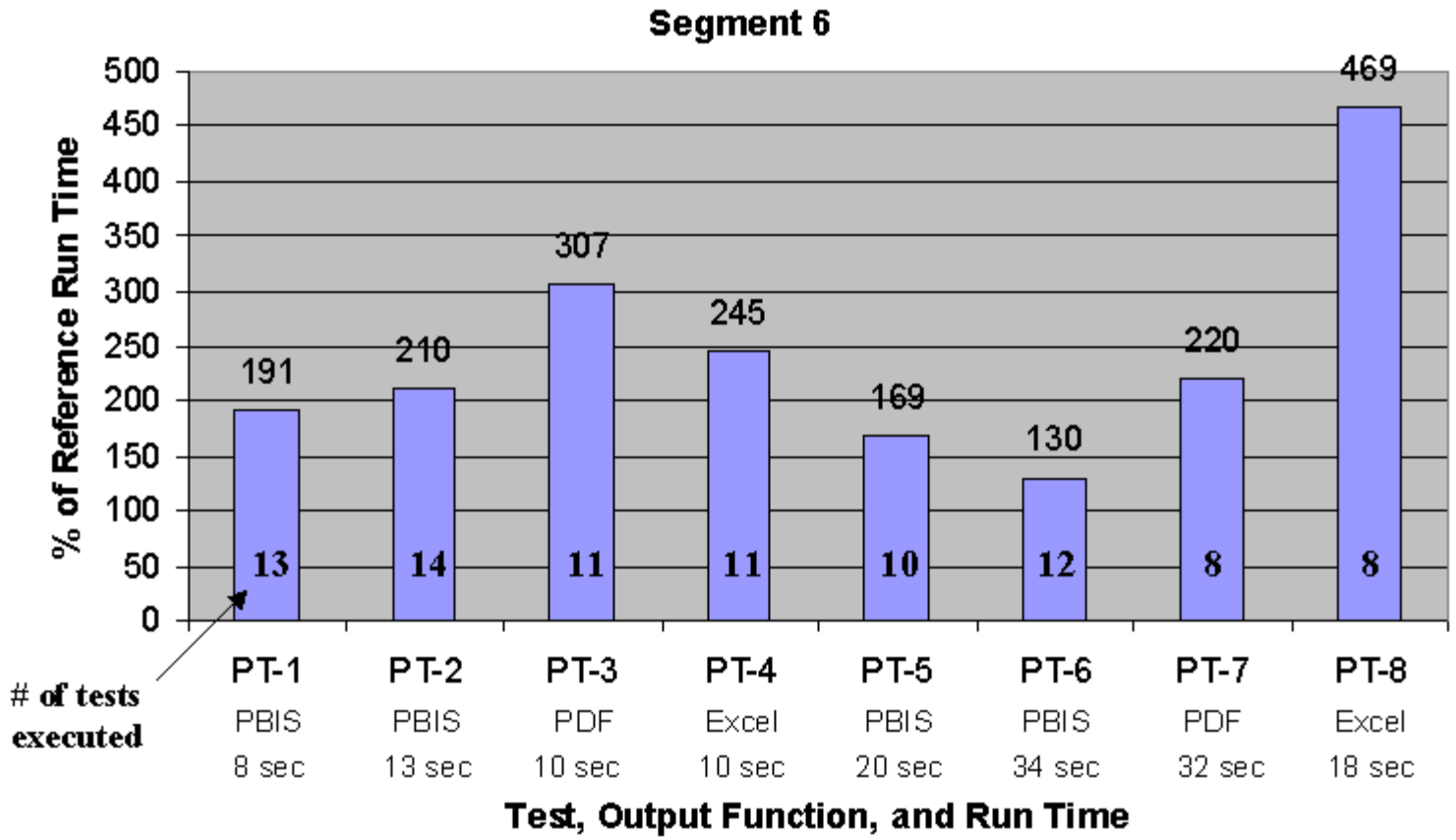

87 Tests were executed during Segment 6

Delays by % of Reference Time

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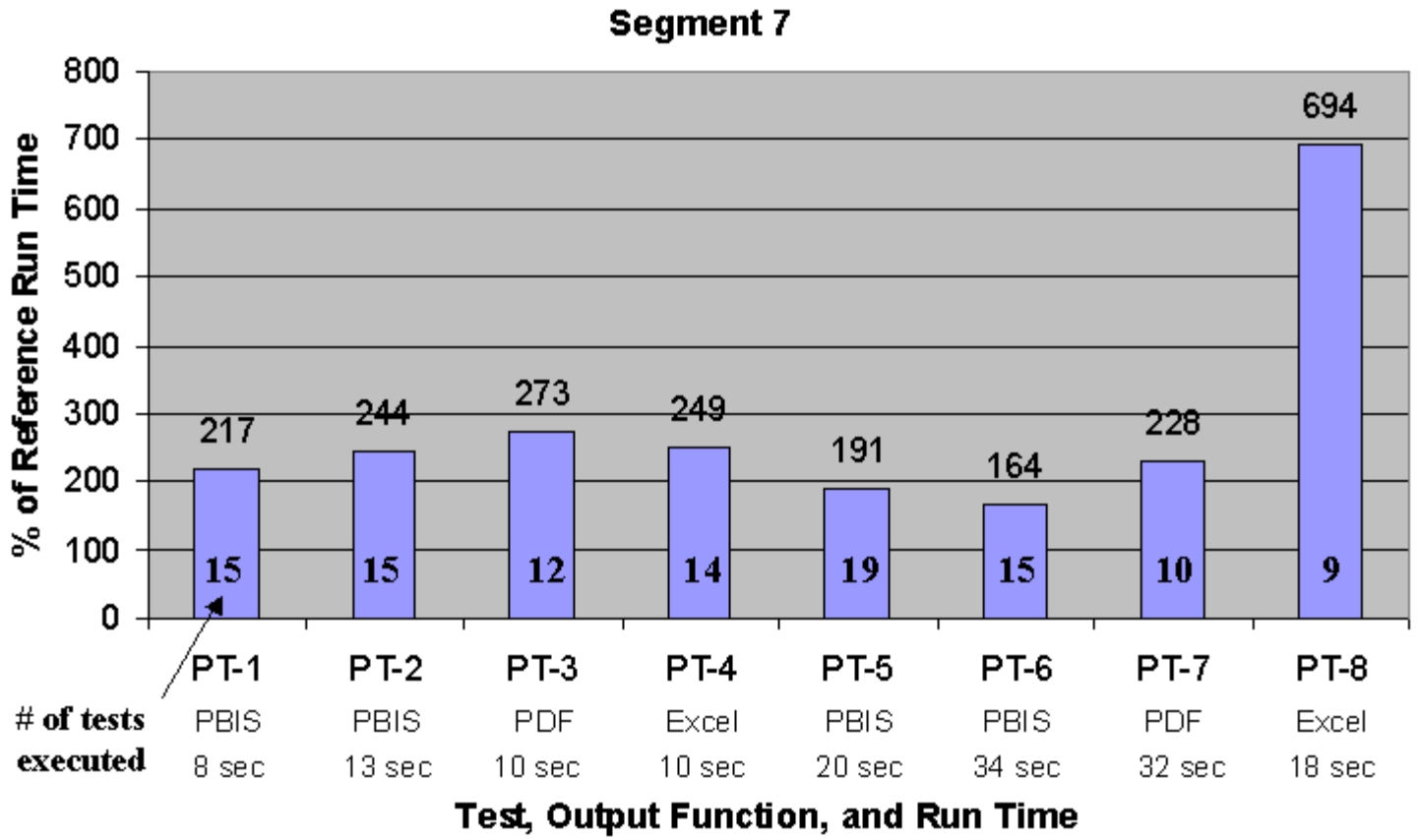

109 Tests were executed during Segment 7

Delays by % of Reference Time

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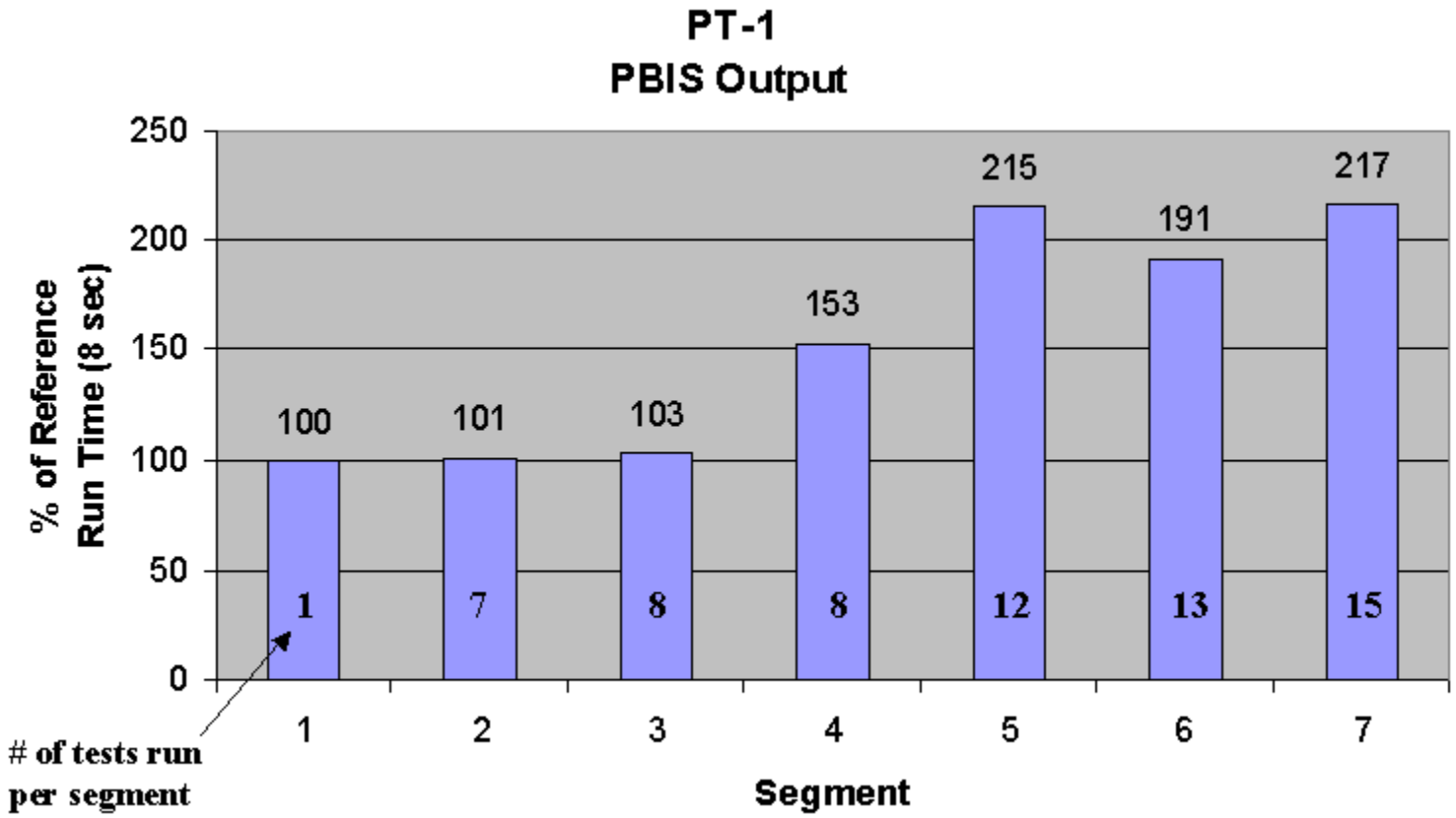

64 PT-1 tests were executed during testing.

Delays by % of Reference Time

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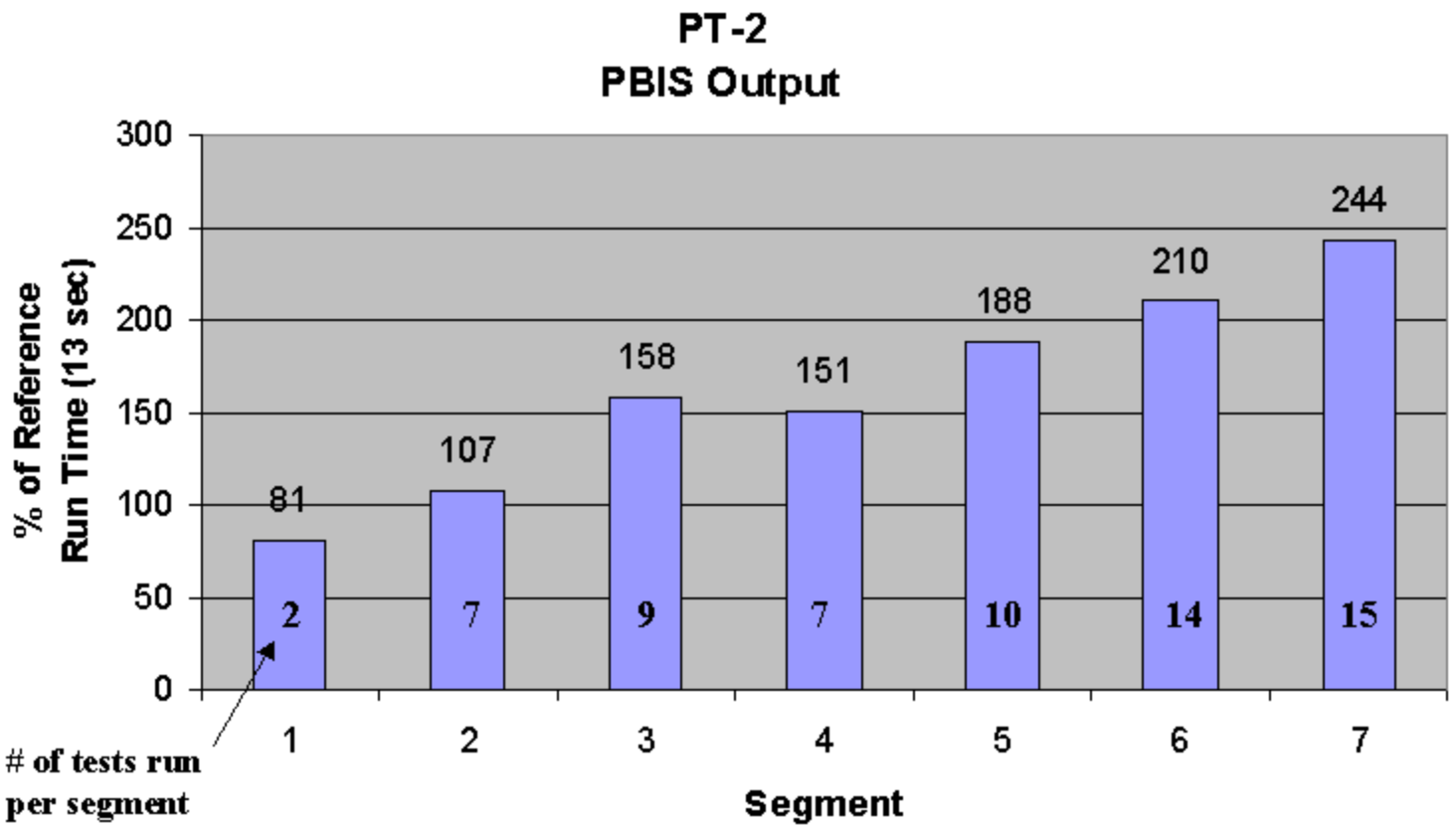
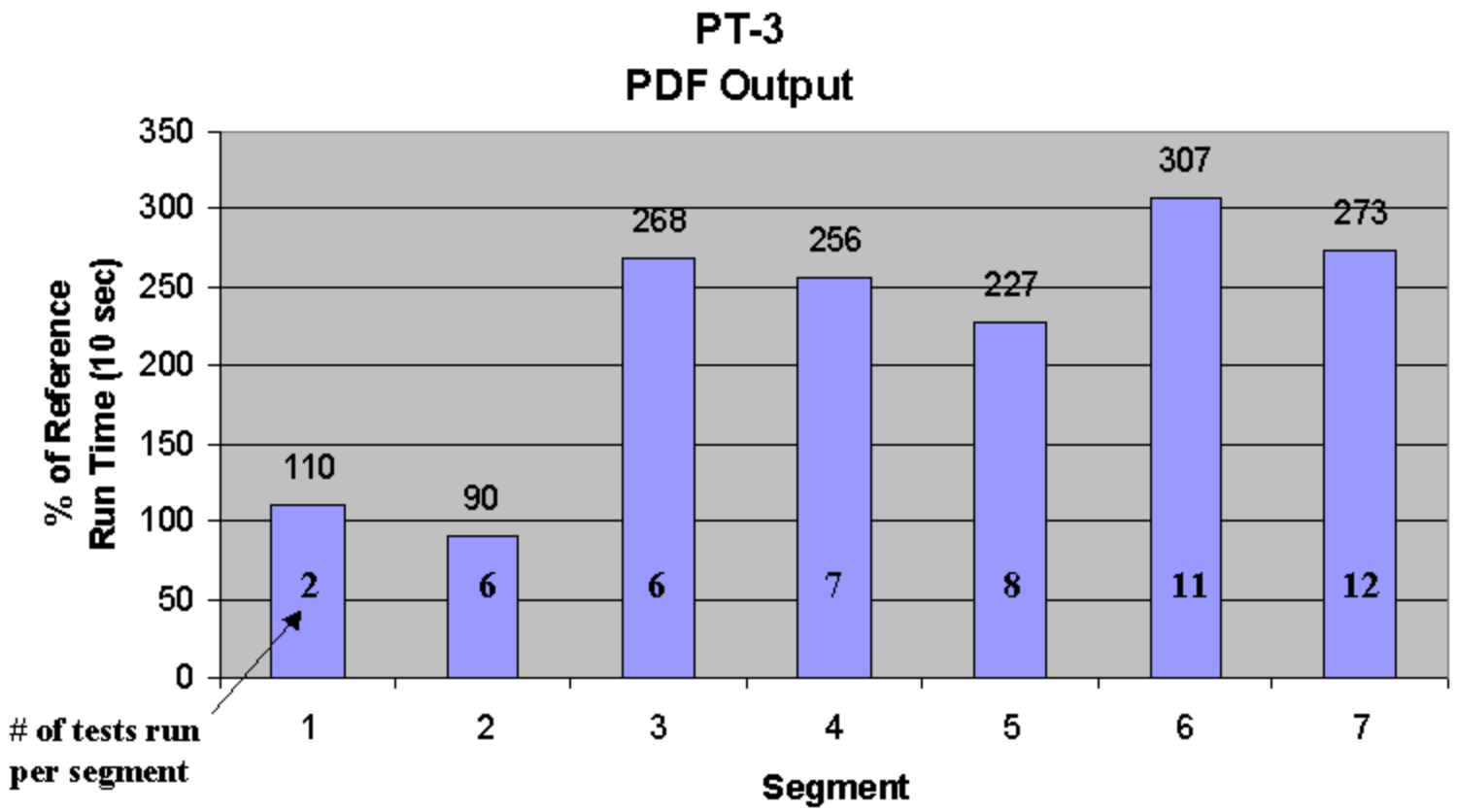


64 PT-2 tests were executed during testing.

Delays by % of Reference Time



52 PT-3 tests were executed during testing.

Delays by % of Reference Time

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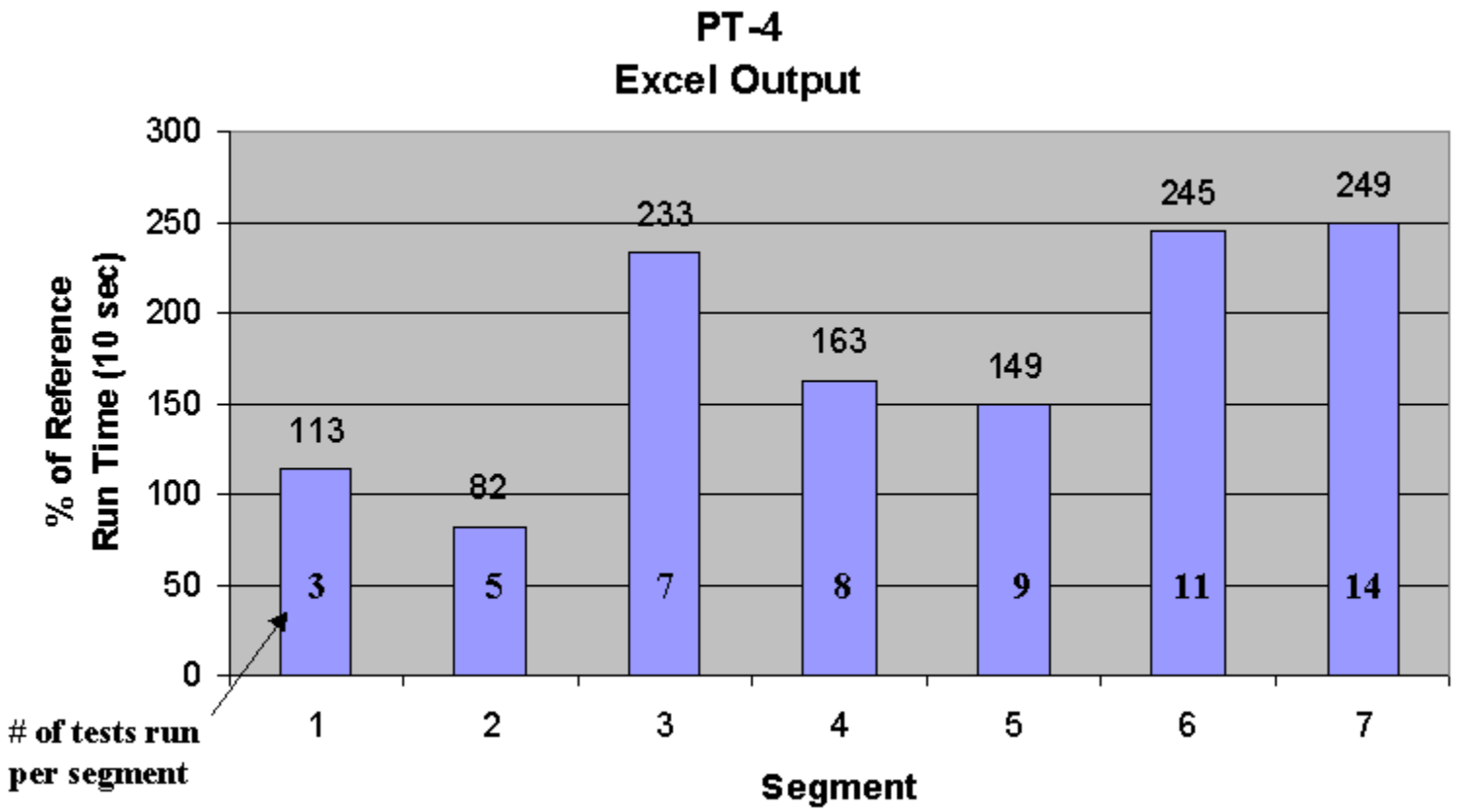
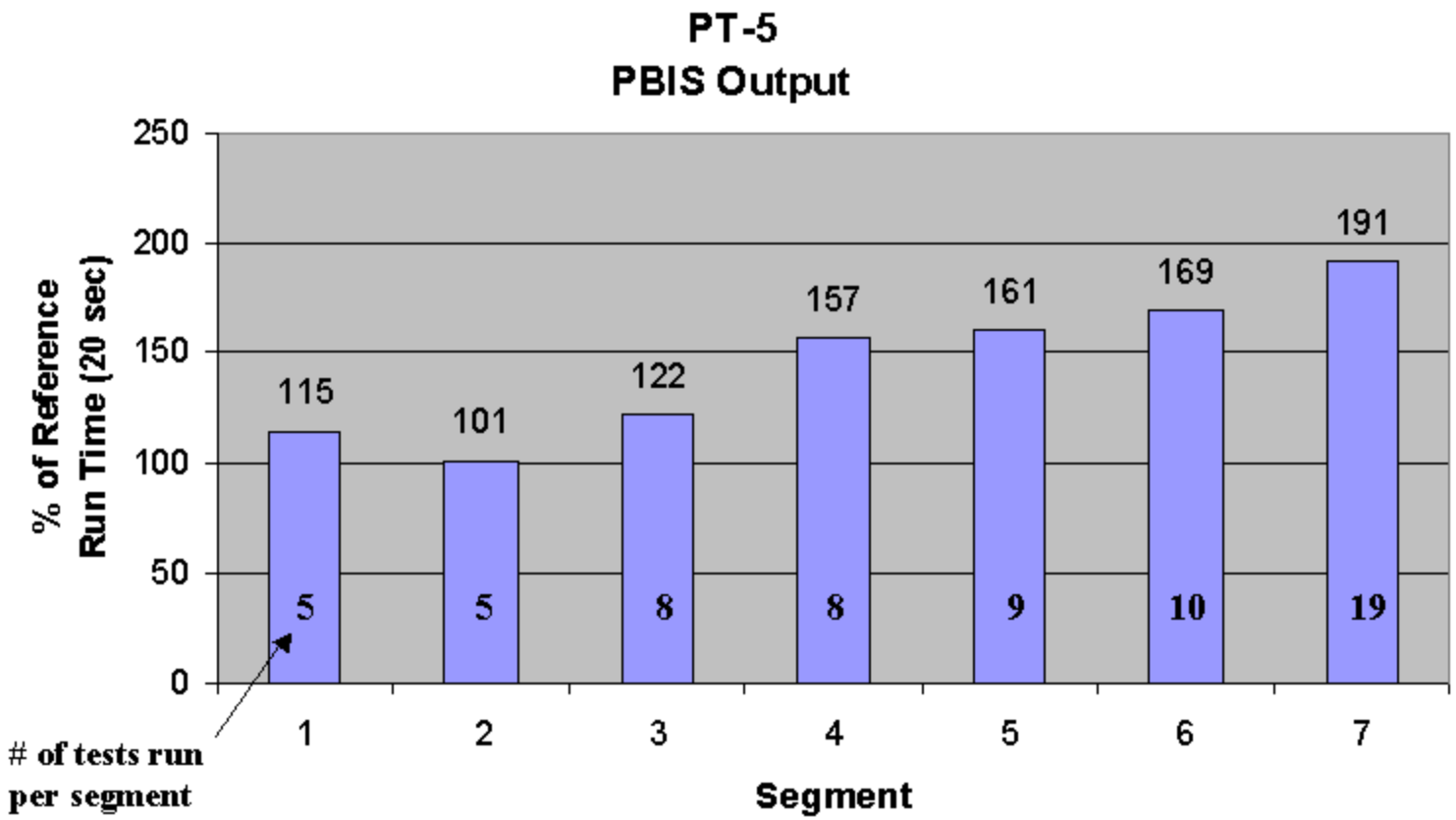


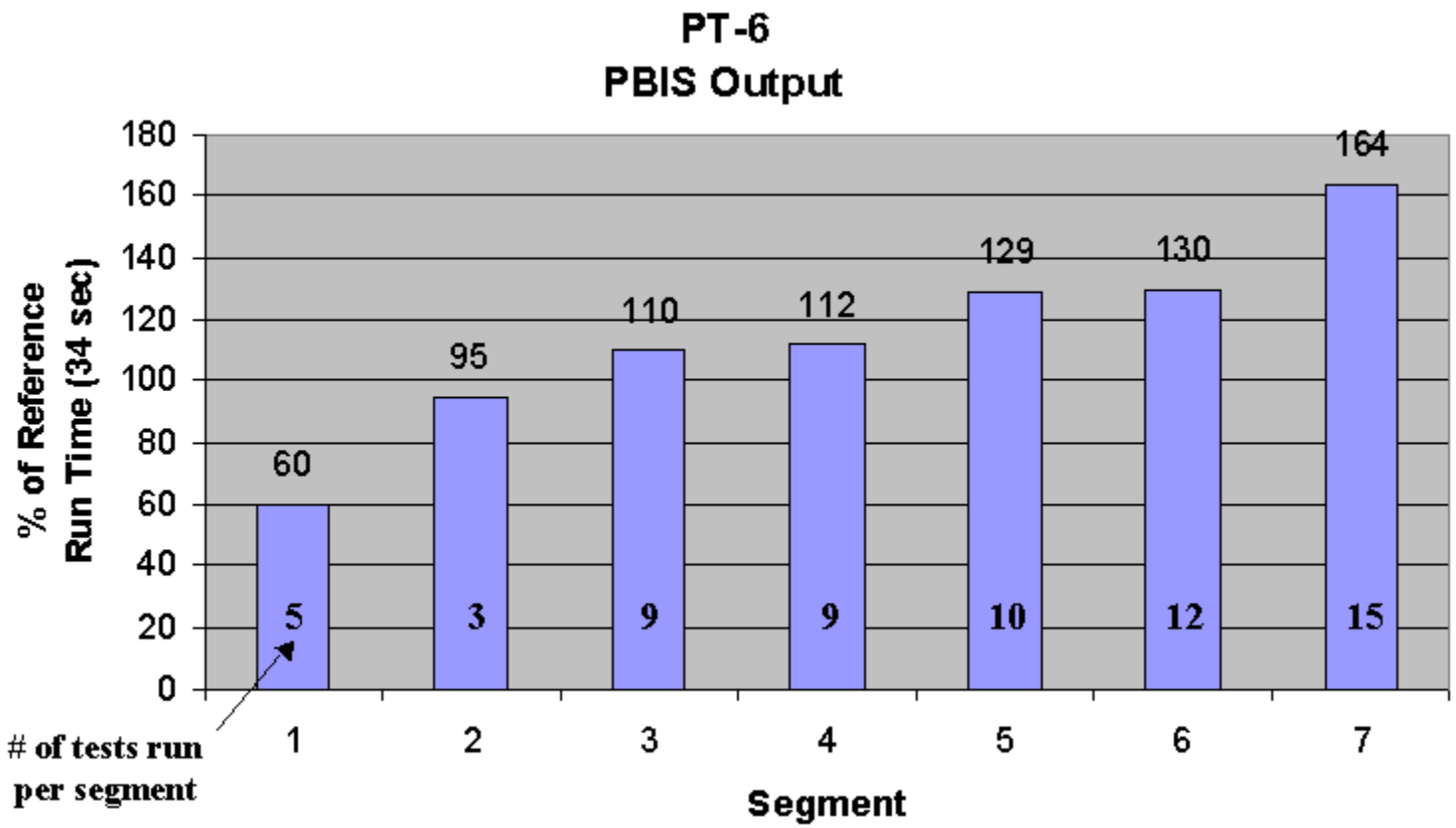
68 PT-4 tests were executed during testing.

Delays by % of Reference Time



64 PT-5 tests were executed during testing.

Delays by % of Reference Time



63 PT-6 tests were executed during testing.

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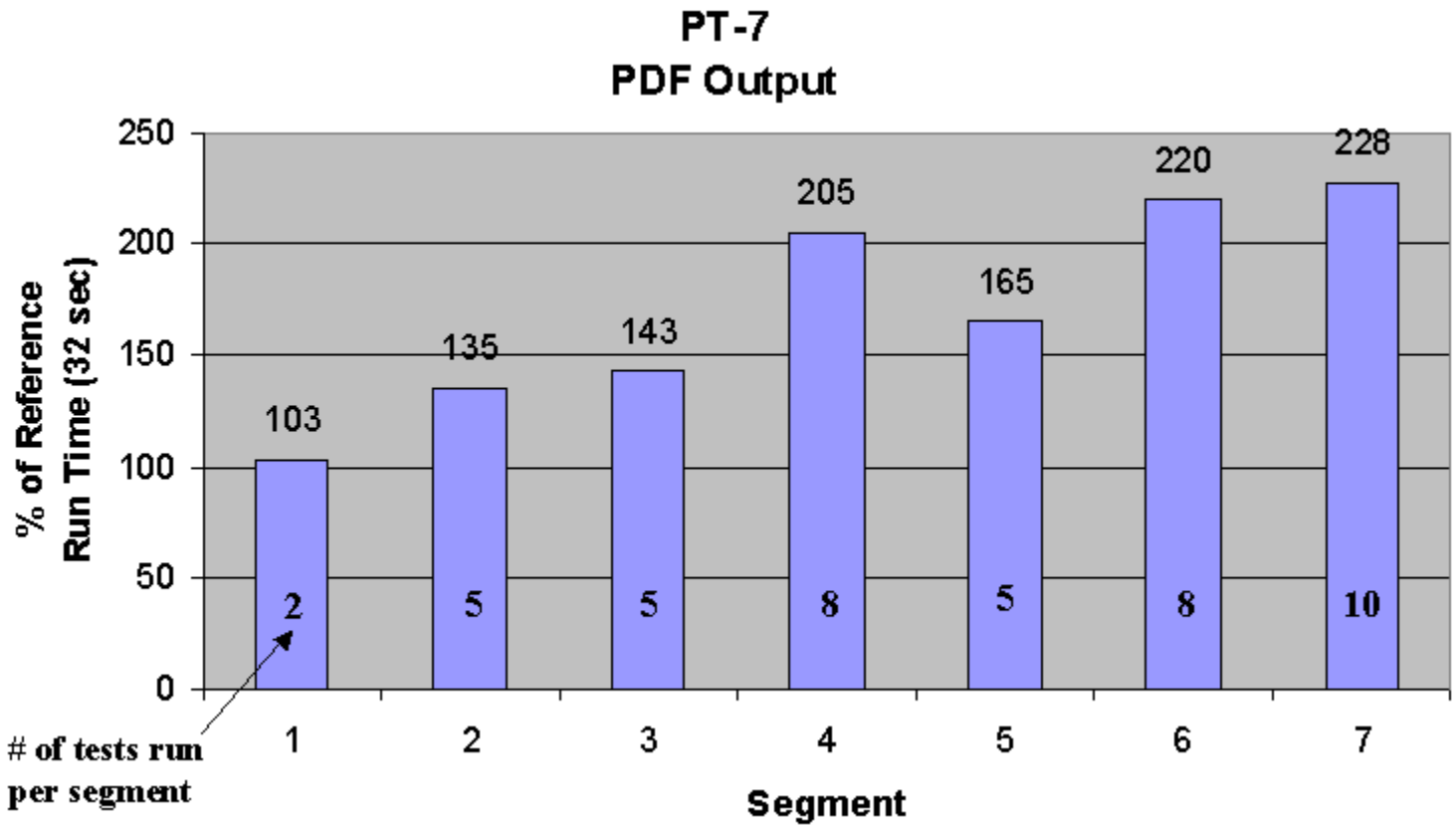
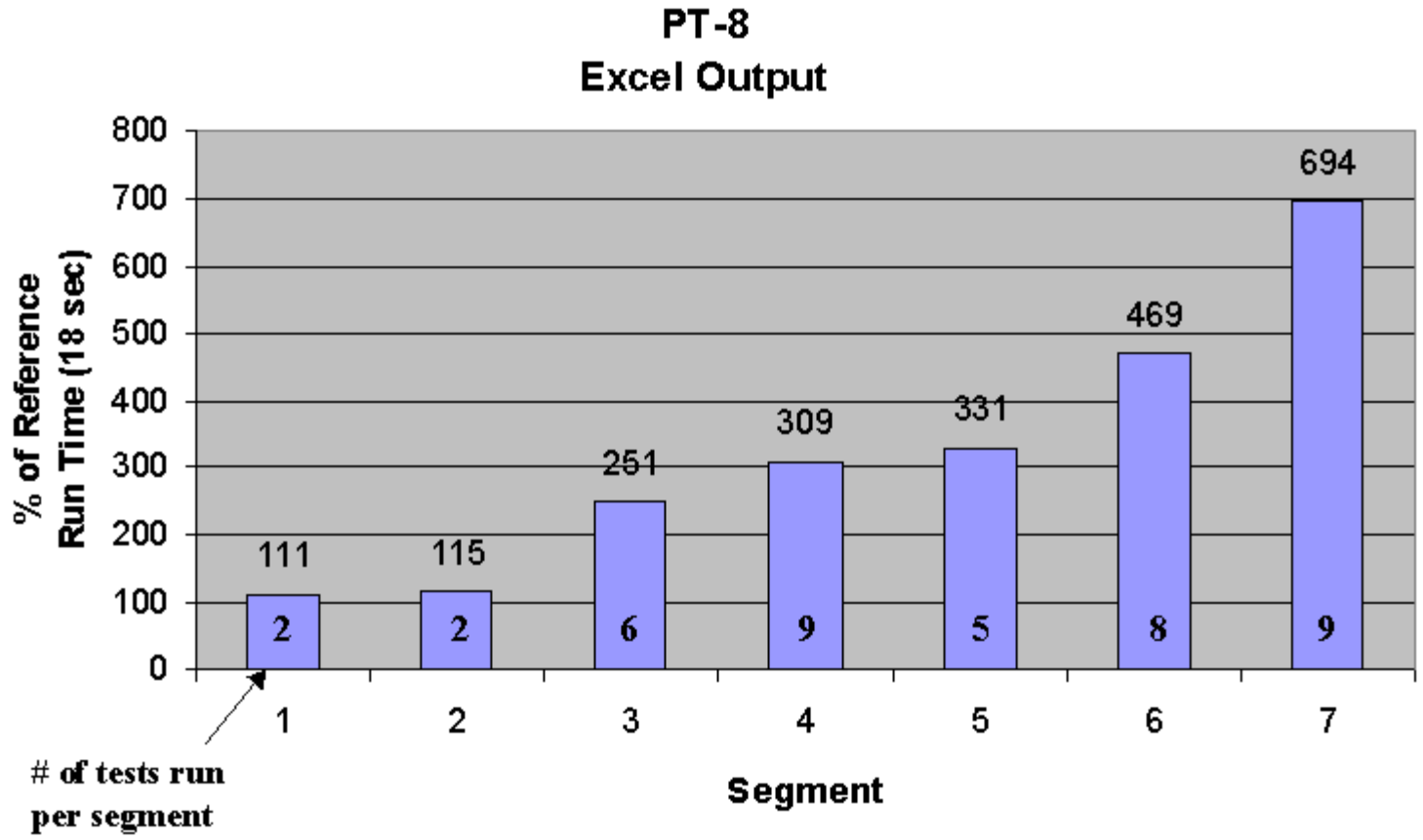
Delays by % of Reference Time



43 PT-7 tests were executed during testing.

Delays by % of Reference Time



41 PT-8 tests were executed during testing.

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